

NASA TECH BRIEF



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Symbolic Reduction of Block Diagrams Using FORMAC

The problem:

The large complex block diagrams used in controls and dynamics can be very difficult to reduce manually for desired symbolic transfer functions needed for further research or for engineering applications.

The solution:

Two computer programs: one written in FORMAC to generate the desired symbolic expressions and one written in Fortran IV to numerically evaluate the expressions.

How it's done:

The FORMAC program consists of four steps:
(1) symbolic reduction of the system of equations of the block diagram to one equation containing the two variables of the desired transfer function;
(2) solution of this equation for the transfer function in terms of the transfer functions for the blocks;
(3) substitution of the system information for the transfer functions for the blocks;
(4) expansion of this equation and collection of terms of the real and imaginary parts.

The Fortran program accepts the symbolic punched output from the FORMAC program in either unexpanded or expanded form. It numerically evaluates the symbolic expressions. The Laplace operator or

driving frequency form is evaluated for particular numerical values of the system parameters involved. Such numerical values as the amplitude ratio and phase angle as functions of driving frequency are computed.

Block diagrams can be handled for any linear constant coefficient system whether it is lumped or distributed parameter as long as an expression for the real and imaginary parts is known.

Notes:

1. This program is written in Fortran IV and FORMAC for use with the IBM 7094 computer with FORMAC compiler.
2. Inquiries concerning this program may be made to:

COSMIC
Computer Center
University of Georgia
Athens, Georgia 30601
Reference: B68-10423

Patent status:

No patent action is contemplated by NASA.

Source: Carl F. Lorenzo and Paul Swigert
of Lewis Research Center
(LEW-10409)

Category 06

the first time in the history of the world, the
whole of the human race has been gathered
together in one place, and that is the
present meeting of the World's Fair.

The following table gives the total amount of each kind of material used in the construction of the bridge.

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and the $\frac{F_1}{F_2}$ ratio is 1.0000000000000002. The F_1 value is 1.0000000000000002 and the F_2 value is 1.0000000000000002.

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As the author has been unable to find any record of the species in the literature, he has given it a name which is derived from the Greek word *lathyrus*, meaning a pea, and the Latin word *luteus*, meaning yellow.

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As a result, the typical methods of the time were used to estimate the values of the parameters.

1960-1961 学年 第一学期 期中考试卷